

CLAIMS

1. An ionic liquid comprising:

at least one anion represented by $[\text{BF}_3(\text{C}_n\text{F}_{2n+1})]^-$ wherein

5 n represents 1, 2, 3 or 4; and

at least one organic ammonium ion represented by
general formula (I):



wherein R^1 to R^4 are the same or different, each
10 representing an alkyl, fluoroalkyl, alkoxy, polyether, or
alkoxyalkyl group, or R^1 and R^2 taken together with the nitrogen
atom may form a pyrrolidine, piperidine, or morpholine ring;
provided that R^1 to R^4 satisfy the conditions (i) through (iii)
shown below:

15 (i) when R^1 and R^2 taken together with the nitrogen
atom form a pyrrolidine, piperidine, or morpholine ring, either R^3
or R^4 is an alkyl group with 3 or more carbon atoms or alkoxyalkyl
group;

(ii) when R^1 and R^2 do not form a pyrrolidine,
20 piperidine or morpholine ring, at least one of R^1 to R^4 is an
alkoxy, polyether or alkoxyalkyl group; and

(iii) when R^1 to R^3 are the same or different, each
being methyl or ethyl, R^4 is a C_{3-10} linear or branched alkyl group.

25 2. An ionic liquid according to claim 1, wherein the
anion is at least one member selected from the group consisting
of $[\text{BF}_3(\text{CF}_3)]^-$, $[\text{BF}_3(\text{C}_2\text{F}_5)]^-$ and $[\text{BF}_3(\text{C}_3\text{F}_7)]^-$.

30 3. An ionic liquid according to claim 1, wherein R^1 , R^2
and R^3 are the same or different, each representing an alkyl group,
and R^4 represents an alkoxyalkyl group.

4. An ionic liquid according to claim 1, wherein R^1
and R^2 taken together with the nitrogen atom form a pyrrolidine,
35 piperidine or morpholine ring; R^3 is methyl or ethyl; and R^4 is an

alkyl group with 3 or more carbon atoms or alkoxyalkyl group.

5 5. An ionic liquid according to claim 1, wherein R¹ and R² taken together with the nitrogen atom form a pyrrolidine, piperidine or morpholine ring; R³ is methyl; and R⁴ is an alkyl group with 3 or more carbon atoms or alkoxyalkyl group.

10 6. An ionic liquid according to claim 1, wherein R¹ and R² taken together with the nitrogen atom form a pyrrolidine ring; R³ is methyl; and R⁴ is an alkyl group with 3 or more carbon atoms or alkoxyalkyl group.

15 7. An electric double-layer capacitor comprising the ionic liquid according to claim 1.

8. A lithium battery comprising the ionic liquid according to claim 1.

20 9. A method of producing an ionic liquid comprising mixing a compound containing as an anionic component at least one anion represented by $[\text{BF}_3(\text{C}_n\text{F}_{2n+1})]^-$ wherein n represents 1, 2, 3 or 4 with a compound containing as a cationic component at least one organic ammonium ion represented by general formula (I):



25 wherein R¹ to R⁴ are the same or different, each representing an alkyl, fluoroalkyl, alkoxy, polyether, or alkoxyalkyl group, or R¹ and R² taken together with the nitrogen atom may form a pyrrolidine, piperidine, or morpholine ring; provided that R¹ to R⁴ satisfy the conditions (i) through (iii)
30 shown below:

(i) when R¹ and R² taken together with the nitrogen atom form a pyrrolidine, piperidine, or morpholine ring, either R³ or R⁴ is an alkyl group with 3 or more carbon atoms or alkoxyalkyl group;

35 (ii) when R¹ and R² do not form a pyrrolidine,

piperidine or morpholine ring, at least one of R^1 to R^4 is an alkoxy, polyether or alkoxyalkyl group; and

(iii) when R^1 to R^3 are the same or different, each being methyl or ethyl, R^4 is a C_{3-10} linear or branched alkyl group.

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